# PCBs in Selected Finfish
# Caught Within New Jersey Waters
# 1981-1982 (With Limited Chlordane Data)

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# Introduction

In December of 1982 the Office of Science and Research (formerly the Office of Cancer and Toxic Substances Research), NJDEP, released a report (13) summarizing five years of fish bioaccumulation data for PCBs. This follow-up report presents the results of subsequent sampling years (1981-1982) and the regulatory actions taken by the State of New Jersey as a result of those findings.

Polychlorinated biphenyls (PCBs) are a group of synthetic compounds with worldwide distribution. Their commercial production began in 1929 and since that time over a billion tons have been manufactured. Production of PCBs ceased in the United States in 1977, following the passage of the Toxic Substances Control Act (TSCA) (PL94-469). Their unique characteristics of thermal and chemical stability as well as their dielectric properties make them well suited for such industrial applications as heat transfer systems, hydraulic fluids and electrical components. It is estimated that only 4% of the one billion pounds of PCBs purchased by U.S. industries has been degraded or incinerated leaving a significant guantity in service, or in landfills, or otherwise uncontrolled within the environment(l). PCBs may be released into the environment through various transport mechanisms including; spills, effluent discharges, incineratlon or stack emvssions, and disposal of end-use products (e.g. transformers, capacitors, etc.) in dumps and landfills. PCBs have shown a wide range of acute and chronic health effects including liver damage, reproductive disorders and skin lesions(2), and they are regarded as a suspected carcinogen by the International Agency for Research on Cancer(3).

Commercial PCB mixtures are manufactured under a variety of tradenames. The tradenames standards used in this report, Aroclor, refers to a series of PCB compounds produced between 1929 and 1977 be Monsanto Industrial Chemicals Co. The Aroclor compound is followed by a four digit code (e.g. Aroclor 1254, Aroclor 1248); biphenyls are generally indicated by 12 in the first two positions, while the last two numbers indicate the percentage by weight of chlorine mixture. For example Aroclor 1260 is a polchlorinated biphenyl mixture containing 60% of chlorine. An exception to this generalization is Aroclor 1016 which is a distillation product of Aroclor 1242 containing only 1% components with five or more chlorine atoms.

In the 1960's, new analytical techniques showed PCBs to be ubiquitous and persistent in tne environment, with the river and coastal sediments acting as transient reservoirst(4). The major factors in the dynamics ot PCB distribution within surface waters are its low solubility, high specific gravity, and hlgh affinity for solids(5). These result in PCB concentrations in the bottom sediments many times higher than the overlying waters(6). PCBs are also highly lipophilic (fat soluble) and can bioaccumulate to high concentrations in fish tissue even when the water concentrations are below the usual detection limits for the compound(7,8,9).

Fish bioaccumulation is a major route of introduction of the chemicals into the human environment via the food chain. Once eaten, the PCBs will distribute themselves in the fatty portions of the human body, much as they did in fish. Continued exposure will tend to increase body-burden concentrations over time, even if exposure levels remain low because of the slow depuration rates for organochloride compounds.

In 1976, concerned by the discovery of broad range PCB contamination of fish and sediments on the upper Hudson River, in New York State(10), the New Jersey Department of Environmental Protection (NJDEP) instituted a comprehensive program to survey the possibility of similar PCB contamination for finfish and shellfish within the lower Hudson River, and also throughout the rest of the State. The project was designed with three main objectives: first, to determine the degree to which aquatic organisms caught in the State are contaminated; second, to determine how PCB levels in fish vary with geography; and finally, to assess the suitability of the fish for human consumption. In keeping with this last objective, we decided to analyze only "edible fillets" of all fish caught, concluding that this would be a more appropriate indicator of health risk to New Jersey's consumers.

Sampling locations were chosen to incorporate: the major drainage basins, locations containing known or suspected sources of PCB contamination, and locations important to either the commercial or recreational fisheries. Sampling was targeted at a number of indicator organisms including species of recreational and commercial importance, and species to be used as ecological indices. Chemical analysis and calculation of concentrations were performed on all samples collected, and compared to standards of Aroclor 1254. Aroclor 1254 was identified after initial broad range PCB scans indicated that this was the major chlorinated biphenyl most resembling the chromatograms of our samples. Standardized composites of five fish were analyzed and periodically, analysis of single samples was performed for comparative purposes. The percent lipid of each sample was also determined since the fatty content of fish has often been correlated with the bioaccumulation of PCBs (10,11,12).

As stated previously, in December of 1982 the Office of Science and Research released a report(13) summarizing five years of sampling data (1975-1980) on PCB content in fish. The results showed that a substantial proportion of the finfish and shellfish analyzed had detectable levels (<0.1 ppm) of PCBs in their flesh (75% and 50% respectively). A small percentage, 2.4% of the finfish, had levels exceeding the existing United States Food and Drug Administration (USFDA) tolerance of 5.0 micrograms of PCB in 1 gram of tissue (ug/g) or 5 parts per million (ppm). The FDA has proposed lowering the tolerance to 2.0 ug/g (see Appendix I for a discussion of FDA tolerances). A total of 11.1% of the finfish exceeded the proposed level. None of the shellfish had contaminant concentrations greater than the proposed 2 ug/g tolerance.

The data showed that those fish which were highly contaminated represent only a few species, with the freshwater groups being much lower in PCBs compared to certain estuarine and marine fish. The geographical

analysis indicated that some drainages and/or geographic sub-regions tended to have more highly contaminated fish than others, and that the heavily urbanized, northeastern corner of the State, within the Hudson-Newark-Raritan Bay complex was most impacted. The Hudson River appears to be the most severely contaminated drainage within the State's waters and although the mean Aroclor 1254 levels in its fish have declined since the mid 1970's those levels detected are still at or near the proposed tolerance of 2.0 ug/g.

A correlation was shown between PCBs and fish lipid content for a number of species indicating a possible method of contaminant reduction for the consumer. Lipid concentration varies throughout the fish body, and for certain species if the fatty portion of the fish is trimmed, (e.g. the belly flap, skin, and lateral line) and the fish is broiled rather than fried as much as 50% of the PCBs contained in the tissue might be eliminated.

1981-1982 Fish Sampling Program

In line with the preliminary (1975-1980) observations, continued monitoring of PCBss in select finfish and waterways of New Jersey was carried out in 1981 and 1982. Sampling site locations for the 1981-1992 seasons corresponded to those waterways and geographic sub-regions indicated by the previous study as having higher levels of PCBs in fish than the rest of the State. Essentially these were the waters of the Hudson-Raritan estuary and the adjacent oceanic waters of the inner New York Bight.

Varying sampling frequency and period was attempted initially in order to provide further information concerning trend analysis and/or fish size contaminant correlations. Selected species of various sizes were actively collected during the fishing season beginning in early May and culminating in late November. However not all fish size classes were collected for every species at each geographic region and seasonal period. This was due partially to the broad migrational patterns of certain fish species and the logistical difficulty involved in having our small sampling team cover the entire oceanic shelf adjacent to New Jersey and the spawning runs into the estuaries simultaneously.

In the middle of the 1981 sampling season analysis for Aroclor 1248 was added to the list of organochloride compounds monitored by our survey. From then on all samples were routinely analyzed for both Aroclors. Also as far back as 1979, the fish samples were analyzed for selected organochlorlde pesticides. These analyses included the alpha and gamma isomers of chlordane which has been declared a carcinogen(14) by the National Cancer Institute and whose uses have been restricted, (i.e., subsurface application for termites) by EPA since 1978 in order to prevent its transport into the environment.

The chlordane results were to have been incorporated into a follow-up report concerned specifically with pesticide contamination. However, both the level of chlordane found in bluefish and the tremendous fishing pressure exerted on these species make it important that the information be released immediately.

The findings of this study resulted in the Department of Environmental Protection announcing fishing closures and/or advisories for select species and waterways of New Jersey in December of 1982. Specifically, striped bass, American eel, bluefish, white perch, and white catfish, primarily from the drainages within the heavily industrialized northeast region of the State, were regulated by the adoption of an Adminlstrative Rule (see Appendix II). The results of the 1981-1982 campaign and the regulatory actions taken are presented here.

## Methods

Estuarine and marine finfish were captured by the use of gill nets, ottertrawls, seines, hook and line, and baited traps. All samples were stored in clean, contaminantÄfree ice chests and kept refrigerated until processing, usually the following day. Each species collected from a particular site was processed based upon its ascending order of lipid content.

Before actual processing, all finfish were weighed, measured and speciated. The samples excised from edible food fish consisted of a skinless fillet portion of the fish. This standard fillet was defined as that portion of the fish bounded anteriorly by the pectoral fin, posteriorly by the caudal fin, and from the mid-dorsal line to the mid-ventral line, including the rib cage and belly flap. These standard fillets were either used as an individual samples from a single fish or combined with other individuals of the same species and size to form a composite sample consisting of five fish. The tissue was then thoroughly homogenized in a blender. Single samples were 100 grams in weight, while composites of five fish (100 gm/fish) were 500 grams. When a 100 gram sample portion was taken from a standard fillet which exceed 100 grams, the sample portion was cut from the anterior section of the fllset proceeding posteriorly until 100 grams was attained. Processed samples were packaged in contaminant free aluminum foil, labeled, and stored frozen until analysis. Field storage of all collected samples was in contaminant free containers filled with wet ice. All sampling procedures and preparation methods follow the U.S. Environmental Protection Agency's (EPA) protocols(15).

The homogenized fish samples were extracted and quantified by gas chromatography at the New Jersey Department of Health laboratory. A Tracor model 222 gas chromatograph was used with an electron capture detector. The USEPA's methods(16) for PCBs and pesticide analysis were used with slight modifications in the initial tissue preparation and extraction section. Seven grams of tissue were soxhlet extracted for six hours in a 3:1 hexane-acetone mixture. The extract was then partitioned with acetonitrile which was again extracted with hexane and then isolated on a florisil column. The final extract was then concentrated and characterized

by gas chromatography and quantified by comparison with Aroclor 1254 and 1248 standards, as well as the alpha and gamma isomers of chlordane. Quality assurance followed EPA recommended guidelines(17) and included spiking muscle tissue of each species with appropriate standards, as well analyzing replicate and blind control samples. The percent recovery for spiked samples internal standards ranged from 80 to 120 percent.

Fish normally exhibit contagious or clumped spatial distributions which may be independent and/or random. This is not uncommon for fish populations which may not sort themselves into schools of similar size classes or congregate in areas of high food availability or areas where other physical factors may be conducive to their growth. This results in fish monitoring data usually being lognormally rather than normally distributed(18), and as a result, data for fish distribution investigations should be transformed by a mathematical formula prior to analyses. If no suitable transformation can be found nonparametric statistics should be applied.

The Food and Drug Adminlstration does not attempt any spatial analysis but instead utilizes a fish-lot analysis(19) for an existing unit of tissue whether it is from a composite or a single sample (e.g. sampling fish from a boat, at the pier, from a wholesaler, from a food distributor, etc.) Only the arithmetic mean are used in all of their summations(20). These practices reflect both the variety of samples and sampling situations that an FDA inspector may encounter in the field as well as the more simplified, fundamental function of the FDA compliance program which is to ensure that deleterious substances do not reach the marketplace for human consumption.

In order to compare our data with data derived by FDA, we calculated the arithmetic means and included all non-detectable values as the lowest limit of the analytical method (0.1 ppm). The mean PCB levels from our 1975-1980 sampling campaigns (4) were also recalculated to include these non-detectable values in order to make them comparable to this 1981-1982 database.

## Results

The results for the 1981-1982 sampling seasons for selected finfish are presented in Table 1 and 2, in two different formats. Table 1 results are for the pooled northeast region data set, displaying both combined and individual Aroclor fractions. This is necessary in order to make comparisons with the 1975-1980 study which was based only on Aroclor 1254 analysis. Table 2 results are subsets of this northeast region data set divided into drainage basins or related waterways as combined Aroclors or totalled PCBs. Results for the bluefish are presented separately in Table 3 and 4.

The northeast region results for combined (total) PCBs in Table 1 generally show elevated (>l ppm) levels for both 1981 and 1982 samples. The mean values for all species, in both years, show levels near or above the proposed FDA tolerance of 2 ppm and for 1982 samples American eel and white perch were near or above the existing tolerance of 5 ppm. It is also evident that Aroclor 1248 is a common contaminant in these species as well as Aroclor 1254.

The striped bass results are divided into two size (age) groups; fish above and below the legal size limit of 18 inches (45.72 cm). Using the Kruskal-Wallis non-parametic test(21), we found that there2is no significant difference between these two size pools (H=0.58; x (1) 0.9=0.45). Both groups also exceed the proposed FDA tolerance. American eel, white perch and white catfish also show elevated Aroclor 1254 levels for both 1975-1980 and 1981-1982.

The levels of Aroclor 1254 in the 1981 and 1982 seasons varied for the five fish species when compared to the 1975-1980 data (see Tables l and 3). The concentrations in American eel and striped bass samples remained relatively constant for all three time periods whereas the levels varied greatly in both white catfish and white perch. White catfish revealed a steady decline for each period examined while white perch levels decreased in 1981 and then increased in 1982. Bluefish levels were reduced in 1982 relative to the 1975-1981 database.

Table 2 allows a more discrete analysis of fish contamination within the Hudson-Raritan estuary. However because or the time constraints mentioned previously the Hudson River was the only drainage sampled in both 1981 and 1982. In spite of this and the limited Aroclor 1248 data for 1981, Table 2 provide an overview of the relative distribution of contaminated fish within whe estuary. Generally, the results indicate elevated PCB levels in all fish species collected for both years. This is consistent for every drainage except the Raritan River, where only two species were caught and they had mean values below 1.0 ppm. For 1981 and 1982 the highest PCB levels were in fish from the Hudson and Passaic Rivers where all of the species exhibited means above the proposed FDA tolerance. Many individual analyses in these data sets were also above the existing FDA tolerance of 5 ppm.

Bluefish results for PCBs and chlordane are shown in Tables 3 and 4. Aroclor 1248 is observed to be a common contamlnant for this species as well as the others. The combined (total) Aroclor levels for 1982 are elevated when all sizes of the fish are pooled together. The size breakdown for this species shows that, unlike striped bass, bluefish present more of a gradient of contamination with smaller fish being reduced in PCBs and chlordane relative to their larger conspecifics. Using the Kruskal-Wallis test we found that there is a significant difference (P=0.005) batween group sizes for total PCBs. (H=20.23; x (2) 0.0005=10.59). The larger bluefish (>60 cm) exhibit a mean total PCB level above the proposed 2 ppm FDA tolerance. It should also be noted that the FDA tolerance established for chlordar.e in fish is 300.0 ppb (ug/kg) and although the overall mean for chlorane in these longer fish (60 cm) is not above this level we did find that 29% of the more sizable bluefish exceeded the exlsting tolerance for the pesticide.

## Discussion

It is difflcult to assess the results for the 1981-1982 sampling season in reference to any one bioconcentrating medium or point-source contamination. The five fish species shown to bioaccumulate PCBs are extremely diverse in habitat,

lifestyle, and food sources. There are a number of common factors though that may link them together.

For instance, they are all species with relatively high fat content and organochloride chemicals such as PCBs and chlordane are extremely lipophilic or fat soluble and can accumulate in this fatty tissue. Also, they were caught within the HudsonÄRaritan estuary and the nearby coastal waters of the New York Bight. These waters drain some of the most densely populated and industrialized areas of the United States and consequently, there is a higher percentage of urban/industrial pollution. Finally, the five fish species are linked by the commonÄ physiological capability of being salinity tolerant to various degrees. That is, they are capable of movements into or across the brackish water which separates freshwater (0.0 parts per thousand of salt) from ocean water (35.0 ppt) within an estuary.

For this investigation we should consider both the white catfish and the white perch as being restricted to estuarine waters. The white catfish is a freshwater species with a maximum salinity tolerance of 14.5 ppt(22). The white perch is usually found in a salinity range of 5-18 ppt althoush both freshwater and estuarine contingents are common. The sampling sites where both species were collected were within their higher salinity tolerances.

The striped bass and the American eel are both diadromous fish, meaning that they are capable of moving from fresh to salt waters or vice versa, usually for spawning. The American eel is catadromous, spending most its life in fresh or brackish water until it migrates to the ocean to spawn. Conversely the striped bass is anadromous. It spends most of its life in the inshore and estuarine regions and migrates into freshwater during the spawning season(23).

The bluefish is primarily a marine fish, but sometimes enters estuarine areas in large numbers. It spawns primarily at sea over the outer half of the contental shelf, but the young of the year may quickly move inshore as the growing season progresses for protection and feeding in the estuaries. It is also known that besides these inshore-offshore spawning movements the striped bass(24) and bluefish(25) exhibit lengthy north-south migrations and may either winter in the Chesapeake Bay or southern Atlantic waters and pass through New Jersey waters in the spring and fall on their way to and from New England. It is this complexity of movement, lifestyle and seasonality which makes it difficult to assess how or where theso fish become contaminated. The more important consideration, from the public health standpoint, is that these rish are being caught locally and can be a significant source of toxic contaminants to New Jersey citizens.

The temporal variation between the overall Aroclor 1254 mean values for all three time periods in Table 1 is not as distinctive as the illustrated in the previous report(4) which compared the 1975-1980 and 1981 samples. That is, the levels of Aroclor 1254 in the 1981Ä1982 season varied quite differently for these five fish species when compared to the 1975-1980 data (see Tables 1 and 3). These fluctuations are difficult to interpret at this time.

It may be indicative of a range of skewness in the non-normalized data set or it may also be due to small sample sizes for white perch and bluefish in the 1981 sampling season and for white catfish in the 1982 season. A larger number of samples from future sampling seasons may help to clearify this anomaly.

The general persistence and variability of PCBs in finfish is probably related to a number of factors including the observation that Aroclor 1254 is less biodegradable and longer lived in the environment then the other Aroclors forms. It is also possible that the low flow and drought conditions in the northeastern U.S. through the late seventies and early eighties may have resulted in depositional environments within our waterways rather than erosional ones. This would effectively remove many PCB laden suspended sediments from the water column periodically and restrict thelr availability for bioaccumulation to these depositional areas. Meteorologic conditions are usually cyclic however and as the flow conditions change due to increased precipitation we might see increasing levels of PCBs within biota at varying times. Continued monitoring of this problem is therefore indicated for the future.

The variation of PCB concentration in different sized bluefish versus striped bass may be related to two phenomena: first, the location of spawning activity and secondly, prey preferences. For example, striped bass in the Hudson River spawn far up into the estuaries after which the juveniles spend at least two years feeding and growing in brackish waters before moving downstream into the deeper waters of the bay and ocean. Therefore, the young-of-the-year and juveniles will spend their early lives feeding in a severely contaminated food chain and possibly absorbing PCBs directly from the water column where each tidal cycle may result in a resuspension contaminated sediment(27). Bluefish, on the other hand, spawn at sea over the continental shelf after which the juveniles move inshore for protection and feeding. They remain a marine fish however and will migrate out to sea and south along the Atlantic coast when winter comes. Their exposure route to PCBs is probably more random and more dependent on the localized contamination of forage fish which they consume coastwide compared to a fish actively growing within the confines of a single contaminated estuary.

The inclusion of the chlordane results for bluefish in this report is relevant not only because the levels of both compounds in the larger fish are high enough to warrant health warnings but because the possible synergistic (combined) health effects of these substances may be even more significant. The chlorinated hydrocarbons (i.e. PCBs and chlordane) may actualiy respond as an additive effect due to their similar chemical properties and that will both accumulate in human fat tissues at proportionately the same rate over time. It is for these reasons that we felt it was important to incorporate this pesticide data into this report.

The relationship between an industrial pollutant such as PCBs and a pesticide such as chlordane appears incongruous at first, since contamination of sediments wlth pesticides is usually considered a problem associated primarily with agricultural soils. Investigations by Carey, Weiersme, and Tai(28)

have shown that clties generally have heavier loads of chlorinated hydrocarbon pesticides in their soil and that pesticide residue levels were generally higher in urban soils than in cropiand soils. They speculate that this is probably due to the compounds being applied to a much smaller land area or perhaps more intensively in the city relative to farm land and possibly resulting in higher runoff rates. Lichtenstein and Polivka(29) also found that 12.4 to 17.8 percent of the chlordane applied to turf plots remained after 12 years in undisturbed sandy loam soil, illustrating the longterm persistence of this compound.

Chlordane has been in use for a long time. It was introduced in the U.S. in 1945 and became one of the most widely used household and garden pesticides. It was registered for use on more than 40 vegetable and 27 fruit crops. After it was declared a suspected carcinogen(14), its applications were severely curtailed by EPA in March 1978. It was permitted only for subsurface ground insertions in termite control and dipping of nonfood items(30).

In spite of this curtailment the widespread use of chlordane continues today for various reasons. The manufacturer of chlordane was allowed a five year period to stop production and meet the terms of the settlement. The settlement allows the public to continue purchasing 1.5 million pounds annually provided that it is sold in minimum one-half gallon containers and labelled "for termite use only." This latter fact in conjunction with the long half-life for biodegradation may speculatively explain the large concentrations of this substance still found in the environment. That is, the consumer still has access to a large volume of the pesticide and may have become inured to its use-limitations by years of applications not specifically related to subterranean application for termites.

## State Regulatory Actions

The regulatory actions taken by the State of New Jersey are clearly explained by an examination of the historical record. ln 1979 the National Academy of Sciences, in a report on PCBs(2) stated that the North Atlantic ocean appeared to be the dominant sink for PCBs, accounting for 50 to 80 percent of PCBs in the environment. Based on this observation, they recommended that further studies were needed to firaly establish PCB concentrations and distributions in the marine environment, especially for fish, because of the potential hazards for human consumption. They also made a policy assessment at that time, stating, "the FDA regulation of PCB limits in fish destined for human consumption appears the most cost-effective method of controlling dietary intake and human health effects than some of the most costly EPA proposed regulations on use and disposal."

In June of that same year (1979), the Food and Drug Administration promulgated a final rule reducing the tolerance for PCBs in fish from 5 ppm to 2 ppm. The rule was then published in the Federal Resister (see Appendix I). They based their decision on the declining incidence of PCB contamination in food

since the original tolerance was set, which meant that PCBs were avoidable in food to a greater degree now than they were earlier, as well as the existence of new toxicity data suggesting chronic toxic effects.

In October of 1979 the final rule was stayed pending a hearing to decide the magnitude of "human food loss" resulting from the proposed lowering of the PCB tolerance in fish and shellfish from 5 to 2 ppm(31). The initial decision of the Adminlstrative Law Judge was not released until February of 1982(32). At issue was the interpretation of how "human food loss" should be calculated. All parties agreed that "retail value" was the best definition for loss and that it should be based on landed (dockside) value of the fish. It would then be calculated times some multiplier in order to account for processlng income (i.e., cleaning, canning, distribution, retailing, etc.)

The magnitude of the multiplier was a disputed issue. The final decision of the judge established that the retail value should be six times the landed value for domestically harvested fish and shellfish. Separate losses were calculated for lobster and alewife (i.e. 10% and 30% catch respectively).

The Judge's decision has been forwarded to the Commissioner of the FDA and his staff is currently evaluating the way it will affect the original rule for reduction.

In December of 1982, the New Jersey Department of Environmental Protection released a report summarizing PCB bioaccumulation in fish for 1975 through 1980. Evaluation of the results of this broader, statewide study caused a change in sampling design and the areas of concentration for the 1981-1982 sampling program. Sampling was centered on the Hudson-Raritan estuary and the adjacent ocean waters of the inner New York Bight.

In evaluating the data from the 1975-1980 report and the yet unpublished results for 1981-1982, the State of New Jersey found itself in an unusual position. The FDA was recommending a reduction of the tolerance levels and had advlsed the states to evaluate their data in reference to the new standard. The litigation concerning "human food loss" had been decided but the FDA still had not made any recommendations or offered any interpretation on the lowered tolerance rule.

After internal peer-review by the NJDEP executive staff, it was decided that the State would act conservatively and in favor of public health. The State concluded that since there were no demonstrated safe levels of PCBs in fish and that the 2 ppm tolerance had already been calculated and recommended by the FDA as a meaningful way to decrease risk to consumers that New Jersey would tentatively forward the 2 ppm tolerance as an advisory limit.

If a substantial number of fish had PCB levels above this level we would "advase" New Jersey consumers to limit their consumption of the affected species from affected drainages to a maximum of one meal a week. Persons at extreme risk such as pregnant and lactating women, women of childbearing age, and small children would be advised not to eat any of the selected species from drainages indicated to be a possible source of the contaminant. The actual closure of fisheries and drainages for commercial fishing would still be based on the tolerance of 5 ppm. These decisions would be tentative and dependent upon final action by the FDA Commissioner concerning the tolerance rule. If future changes in the tolerance were enacted and finalized, New Jersey would respond accordingly by amending the existing administrative rule.

Overall the 1981-1982 data showed that the five species identified had elevated PCB levels relative to the Food and Drug Administration's existing and proposed tolerance. Using the proposed tolerance as a lower limit and the existing tolerance as an upper limit, the State set a number of regulatory advisory ranges. The percentages of fish falling within each category for the "Northeast Region" on New Jersey, in 1982, were calculated. Table 5 shows these percentages. Twenty-five percent or more of each of the five selected finfish showed PCB results within the 2 to 5 ppm advisory range. In addition, striped bass, American eel and white perch showed a high percentage of their analyses (29-67%) in the closure range (>5 ppm). It should be noted that the white perch results were based on a small number of samples. After careful evaluation, the advisories and closures were formulated relative to the appropriate drainages and species as described in this report and formalized in an administrative rule (see Appendix II).

The results of the New Jersey study and the closure-advisory recommendations which were made are not at all surprising. New York State has had fishing advisories in effect on the Hudson River since 1976(34) because of PCB contamination. NJDEP's results are generally in agreement wlth studles conducted by New York State(26) on the Hudson River and the National Marine Fisheries Service(35) for offshore species. In fact, the latter agency stated in its "Report to the Congress on Ocean Pollution" that one of the principal findings of its Northeast Monitoring Program was that species occurring over a wide range from the coastal waters of the New York Bight apex to the Outer Continental Shelf/slope break, showed unexpectedly high levels of these contaminants (i.e., PCBs and Polynuclear Aromatic Hydrocarbons)(33).

The conservative nature of this action was also borne out by the results of a recently released EPA study investigating the levels of PCBs ln human adipose tissue and mothers' milk(36). Although the study showed that overall there was a sharp decline in the percentage of the U.S. population having levels of PCBs above 3 ppm in their fat tissue, it indicated that the northeast census region, which includes New Jersey, was outside this norm. It had the highest percentage (9.2%) of adipose tissue samples with levels in excess of 3 ppm. The northeast region also had the highest percentage (38.2%) of elevated PCB levels (>0.05 ppm) in human mothers milk. Therefore any means of reducing the levels of PCBs reaching the residents of New Jersey is an appropriate reaction for a population already in the highest exposure group.

NJDEP also sought out administrative guidance from all of the federal agencies involved in this issue (i.e., Food and Drug Administration, National Marine Fisheries Service, and Environmental Protection Agency). To date the FDA has not made a final decision on its recommendations for reducing the PCB tolerance in fish to 2 ppm because it is still under review within the FDA commissioners office. They did respond however, after reviewing the present report, that, "they are gratified by the action being taken by the officials from the NJDEP to minimize, where possible, the exposure to PCBs. The concept and procedures used to control the consumption of selected finfish for PCBs appear sound."

The National Marine Fisheries Service (NMFS) and the Environmental Protection Agency (EPA) sent representatives to meet with the NJDEP and the problems of regulatory and jurisdictional overlaps were discussed. The inadequacy of artificial human boundaries such as state waters (3 mile limit) and federal waters (3 miles to 200 miles) especially in reference to highly mobile species such as bluefish and striped bass became quite apparent. These fish may range inshore-offshore crossing both regulatory jurisdictions as well as travelling north-south across state boundaries. It was noted that the export of regional contamination is not only possible but quite probable and that a multi-state, cost-wide assessment of the bioaccumulation of toxics by oceanic species is in order. A combined Federal/States Agencies cooperative task force was indicated as the best means for doing this and will be forming in the near future.

Discussion also pointed out that NMFS and NJDEP sampling programs were not compatible in fundamental ways. Essentially, NMFS collects fish for tissue analysis on its annual ground surveys of bottom sediments and organisms. They chose an indicators species for organochloride analysis fish which are generally demersal or benthic feeders. That is, organisms that live on or near the sea floor. These species were considered to best reflect any bioaccumulation of contaminants from the benthic organisms and sediments which serve as a repository for organochlorides such as PCBs(37). Unfortunately bottom trawls under-represent mid-water fish. Yet these species are the major concerns for PCBs in New Jersey waters (i.e., bluefish, striped bass). In fact, the NMFS list of important indicator species includes only one fish (winter flounder) shown by their own surveys(38,39) to be the most commonly landed species for New Jersey commercial and recreational fishermen (see Tables VI and VII).

The FDA, in its own survey of 1978-79 tor PCB residues in fish describes 12 species of interest (i.e., those species of fish found to have the highest PCB residue levels) which included the following five marine fish: bluefish, mackerel, drum, scup (porgy) and sea trout (weakfish). All of them showed a mean PCB value of approximately 0.5 ppm for this smaller survey covering larger bodies of coastal water(40). None of these species are routinely represented in the annual NMFS survey. The necessity or including them in future sampling was discussed and will be incorporated.

As stated, the main objective of this study was to ascertain the possible health risk to fishermen and consumers in relation to their dietary intake. Therefore, we caught edible fish to be evaluated for the transport of contaminants to the human food chain. NJDEP is now investigating this contamination back to its sources and also developing possible remedial actions for the cleanup and prevention of similar problems in the future. For example, the Office of Science and Research has instituted a study to investigate the levels of organic contaminants entering and leaving publicly owned treatment works (POTWs) and sewage treatment plants (STPs) which receive industrial effluents. Influent, effluent and sludge are being sampled and analyzed for PCBs and other common industrial wastewater contaminants. The results will be instrumental in evaluating how well these facilities remove contaminants from the wastewater stream, and how much is partitioned into the sludge. This data can then be used by several governmental agencies. The NJDEP enforcement sections may use this data for immediate remediation. Pretreatment programs will use this baseline database for wastewater pretreatment regulations which are now being promulgated by EPA for source control. In addition, the Ocean Waste Management Committee which is currently evaluating the impacts of ocean dumping of sludge and sediments, will be able to determine proportionale contributions from known sources.

In conjunction with this effort the Office of Science and Research will also be sampling bottom sediments for PCBs from various location within the state. The relevance of these PCB laden sediments and sludges, as well as the locations of their ultimate disposal, will be investigated first by developing better sampling methods for bulk materials, and then instituting fate studies at the locations of their ultimate disposal. Finally, the NJDEP will continue to catch and analyze fish for PCB and pesticides on an annual basis. Sampling and analysis will also be expanded to include any other toxic compound liable to bioaccumulate in fish transport to the human food chain.

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# APPENDIX I

# APPENDIX I

*Excerpted from: "Polychlorinated Biphenyls (PCBs): Reduction of Tolerance, Final Rule." (FR Vol. 44, No. 127, 38330-38340, Friday, June 24, 1979)

Food is adulterated and thus prohibited from interstate commerce if it contains "any added poisonous or added deleterious substance" that is unsafe, which means that its presence in the food is required in the production thereof or cannot be avoided by good manufacturing practice.

The FDA is authorized to promulgate regulations limiting the quantity of such a required or unavoidable substance that can be legally present in food. Such limits, called tolerances, are to be set by FDA at the level found necessary to protect public health. Once established, any food containing that substance in an amount exceeding the tolerance is deemed adulterated.

Once the contamination occurs, there is little that can be done to remove the PCBs from the water or the fish; their presence in that sense is unavoidable. Because the initial contamination of fish with PCBs cannot be avoided (nor the PCBs processed out), the only way to avoid PCBs in fish is to remove fish from commerce if they contain PCBs above a given tolerance level.

The toxicological data available on PCBs make it clear that, in an ideal situation; it would be preferable not to have PCBs in food at any level. It is equally clear, however, that the reduction of PCB exposure from food sources to zero, or to a level approaching zero, would require elimination of large amounts of food, especially fish.

FDA has to decide therefore, where the proper balance lies between providing an adequate degree of public health protection and avoiding excessive losses of food to American consumers. FDA considers the (existing PCB) data to provide a more than adequate basis for the exercise of its judgement in reducing the PCB tolerance.

Rationale: Based on the declining incidence of PCB contamination in food since the original tolerance was set, which means that PCBs are avoidable in food to a greater degree now than they were earlier, as well as the new toxicity data suggesting chronic toxic effects, the FDA decided the PCB tolerances should be reduced.

There is little genuine dispute over the fact that exposure to PCBs must be considered to pose a risk of serious, chronic toxic effects in humans. (i.e. adverse reproductive effects, tumor production, and, possible carcinogenicity). The real question raised by comments to the FDA rule is whether the degree of risk reduction accomplished by lowering the fish tolerance to 2 ppm is sufficient to justify the increased loss of food that the lower tolerance will cause.

However, FDA calculated that a 2 ppm tolerance would effect a meaningful decrease in risk to consumers while still excluding from commerce only a relatively small amount of food (about $5.7 million landed value in 1974 dollars).

The FDA has reason to believe that the claims of adverse economic import are exaggerated. Although it is possible that fishing for certain heavily contaminated species may close entirely in locations where PCB contamination is concentrated, at least some affected fishers - both commercial and sport - can be expected to adjust to the reduced tolerance by increasing their catch of other species or transferring their activities to other less contaminated locations within their current area of operation.

The average consumer who eats fish from a variety of freshwater and marine sources will actually experience a far lower level of PCB exposure and a correspondingly lower degree or risk than those whose fish consumption is concentrated among the more heavily contaminated (predominantly freshwater) species.

The average consumer eats a modest amount of fish from a variety of sources, both freshwater and marine, most of which yield fish with PCB levels below 1 ppm.

A typical heavy consumers (e.g. the Great Lakes sport fishermen who catch and consume large quantities of the contaminated species) would likely not be adequately protected by even a 1 ppm tolerance because of the amount of fish they eat and because those fish are seldom affected by FDA tolerances (either because they are sport fish or are from intrastate commercial channels and, in either case, are outside FDA's jurisdiction). Protection of these consumers depends on actions by State authorities.

FDA's risk assessment, using data from a study of Lake Michigan sport fish eaters, estimated that the upper limit on the lifetime risk of cancer for heavy eaters of sport fish from Lake Michigan is about 12 to 14 times greater than the corresponding risk for heavy eaters of those commercial fish most affected by a PCB tolerance, even assuming the tolerance remained at 5 ppm.

FDA urges State and local health officials to evaluate the situation in their own localities and determine what steps, if any, they can take to address these special situations. There agencies should also review their past actions in light of the current state of knowledge about PCBs and make the changes or take the additional steps that may now be appropriate.

The agency (FDA) is advising that state health departments be particularly concerned about women of childbearing age, especially pregnant and lactating women, who may have consumed, or are consuming, higher than normal amounts of PCB contaminated fish. Data suggest an association between reproductive disfunction in mothers as well as acute toxic effects in the nursing offspring of laboratory animals.

FDA does not have the authority to close waters to fishing or to prohibit harvesting or possession of fish. Any actions to close waters to fishing would have to be instituted by State agencies. FDA is only authorized to impound fish lots exceeding the tolerance level of fish that are involved in interstate traffic.

# APPENDIX II

# EMERGENCY ADOPTIONS

## ENVIRONMENTAL PROTECTION

## (a)

## OFFICE OF CANCER AND TOXIC SUBSTANCES RESEARCH

**Fisheries Closures and Advisories for Striped Bass, American Eel, Bluefish, White Perch and White Catfish Taken from the Northeast Region of the State**

**Adopted Emergency New Rule and Concurrent Proposal: N.J.A.C. 7:25-18A**

Emergeney New Rule Adopted: December I5, 1982 by Robert E. Hughey, Commissioner, Department of Environmental Protection.

Emergency New Rule Filed: December 15, 1982 as R. 1982 d.477.

Authority Marine Fisheries Management and Commercial Fisheries Act, N.J.S.A. 23:2B-I et seq.

Emergeney New Rule Effective Date: December 15, 1982.

Emergency New Rule Expiration Date: February 14, 1983.

DEP Docket No 060-82-12.

Interested persons may submit in writing, data, views or arguments relevant to the proposal on or before February 3, 1983. These submissions, and any inquiries about submissions and responses, should be addressed to:

Thomas Burke, Director
Office of Cancer and Toxic
Substances Research
CN 402
190 West State Street
Trenton, NJ 08625

This new rule was adopted on an emergency basis and became effective upon acceptance for filing by the Office of Admininstrative Law (see N.J.S.A. 52:14B-4(c) as implemented by N.J.A.C. 1:30-4.4). Concurrently, the provisions of this emergency new rule are being proposed for readoption in compliance with the normal rulemaking requirements of the Administrative Procedure Act, N.J.S.A 52:14B-I etseq. The readopted rule becomes effective upon accptance for filing by the Office of Administrative Law (sec N.J.A.C. I :30-4.4(d)).

The concurrent proposal is known as PRN 1983 - 20 .

The agency emergency adoption and concurrent proposal follows:

**Summary**

The toxicity of polychlorinated biphenols ("PCB's") has becn known for many years. PCB's are a suspected human carcinogen. Birth defects and a wide range of acute and chronic health affeets have been attributed to PCB's which bioaccumulate in humans. Virtually, everyone has some level of PCB's in their body. Recent
surveys by the Federal Drug Administration ("FDA"} indicate that fish are the most significant source of dietary exposure.

Sinse 1976, the Office of Cancer and Toxic Substanccs Research and the Division of Fish, Game and Wildlife within the New Jersey Department of Environmental Protection have been conducting a comprehensive survey of possible PCB's contamination of finfish and shellfish throughout the State. The three main objectives of the Department's PCB Project has been to determine: I ) the degree of PCB contamination of aquatic animals caught in the State; 2) how the PCB levels of aquatic animals vary due to geographic factors: and 3) the suitability of aquatic animals for human consumption. Only "edible fillets" of all fish caught were analyzed The Department determined edible fillet testing to be the most appropriate health risk indicator for New Jersey's consumers. The fish were analyzed for "Aroclor 1254", the most persistent and toxic mixture of PCB's, and, recently, for "Aroclor 1248". All analyses were carried out by the New Jersey Department of Health laboratories. Sampling locations were selected to incorporate areas of known or suspeeted PCB contamination, areas important to commercial or recreational fisheries and areas of major drainage basins. Indicator aquatic organisms included species of commercial and recreational imponance and other ecological indicators.

The results of these efforts have been presented in a Departmental report entitied "Polychlorinated Biphenyls (Aroclor 1254) in Fish Tissues Throughout the State of New Jersey: A Comprehensivc Survey". The study finds that a substantial proportion of the finfish and shellfish analyzed had detectable levels of PCB's in their edible flesh (75 percent and 50 percent respectively). A smaller percentage, 2.4 percent of the finfish, had levels exceeding the existing FDA action level of 5.0 ug/g (parts per million) The FDA has proposed lowering the action level to 2.0 ug/g (ppm). A total of 11.1 percent of the finfish exceeded the proposed level. None of the shellfish had contaminant concentrations greator than the proposed 2 ug/g action level.

The data also shows that those fish which are highly contaminated represent only a few species, with the freshwater groups being much lower in PCB's compared to the saltwater and migratory fish. The study results show that six species of fish have concentrations at or exceeding the five parts per million level. The White Catfish, a freshwater species, is much lower in PCB on the average, than are the Striped Bass, White Perch, American Eel, and Atlantic Sturgeon; all diadromous or migratory fishes and the Bluefish, a marine fish.

The geographical analysis indicates that some drainages and or geographic subregions tend to have more highly contaminated fish than others and that the heavily urbanized northeastern corner of the State, within the Hudson-Newark-Raritan Bay Complex, is especially impacted. The term Northeast Region" has been defined for the purposes of this emergency rule as that region encompassing the New Jersev portion of Sandy Hook and Raritan Bays, the tidal portion of the Raritan River upstream to the Route I Bridge in New Brunswick; the Arthur Kill and Newark Bay: the Passaic River up to Dundee Dam: the Hackensack River up to

Oradell Dam the Kill Van Kull and Upper New York Bay: and the Hudson River up to the New Jersey-New York Border, approximately four miles above Alpine, New Jersey. The Hudson River appears to be the most severely contaminated drainage within State waters and although the mean PCB level for its fish has declined since the mid 197O's the combined levels of several PCB compounds for many Hudson River fish are still above the existing action Ievel of 5 ug/g(ppm).

The Department realizes the importance of commerical and recreational fisheries to the economy and enjoyment of the citizens of the State. Futhermore, the Department understands the broad



range public health threat associated with the contamination of fisheries. Human health remains extremely sensitive to aquatic releases of toxic chemicals.

Therefore, the Department finds that an imminent peril of serious public health problems exists due to PCB contamination in certain species of finfish in particular areas of the State's waters, necessitating the following emergency action by the Department.

Prohibition of the sale of Striped Bass (Morone saxatilis) taken from the Hudson River, Upper New York Bay, Newark Bay, Lower Passaic River, Lower Hackensack River, Arthur Kill and Kill Van Kull. Also, an advisory to "limit consumption" of Striped Bass taken from the Northeast Region and the offshore State waters in the northern coastal area of the State. ("Limited consumption" for the purposes of this emergeney rule means that in order to reduce exposure to and accumulation of PCB's, persons of high risk, such as pregnant women, nursing mothers, women of child-bearing age and young children, should not eat any fish taken from the regions designated above and all other citizens should consume not more than one meal per week of such fish.)

Prohibition of the sale of American Eels (Anguilla rostrata) taken from the Hudson River, Upper New York Bay, Newark Bay, Lower Passaic and Hackensack River, the Arthur Kill and Kill Van Kull. Also an advisory to limit consumption of American Eels taken from the entire State, especially the Northeast Region.

An advisory to limit consumption of Bluefish (Pomatomus saltatrix) taken from the Northeast Region, including the offshore State waters in the northern coastal area of the State. The advisory has primary relevanee to Bluefish exceeding 24 inches in length or six pounds in weight.

An advisory to limit consumption of White Pereh (Morone american) taken from the Northeast Region.

An advisory to limit consumption of White Catfish (Ictalurus catus) taken from the Northeast Region.

The Department shall utilize all reasonable and effective methods to publicize and educate the citizens of the State concerning the contents of this emergeney rule. The Department shall utilize press conferences, press releases, Departmental mailing lists, public notice in State newspapers, and posting of signs in appropriate locations. Copies of the adopted emergeney rule shall be made available to the public upon request.

**Social Impact**

A major positive social impact will result from the adopted emergeney rule. Imminent public health problems due to PCB contamination of Striped Bass, American Eel, Bluefish, White Perch and White Catfish taken from the Northeast Regions of the State by citizens of the State shall be eliminated due to citizen compliance with the closures and advisories established in the adopted emergency rule. The bioaccumulation of PCB's in the fish consuming public of the State shall be substantially decreased, thus reducing the risk of cancer and other serious health problems.

**Economic Impact**

An adverse economic impact of the adopted emergency rule will be caused by the prohibition of the sale of Striped Bass and American Eel in the Northeast Region of the State and by the reduction of consumption advised for Striped Bass, American Eel, Bluefish, White Perch and White Catfish taken from the Northeast Region of the State. This negative economic impact (upon commercial and recreational fishing) will, however, be offset by the overall public health benefit of reducing the consumption of PCB contaminated fish taken from the Northeast Region of the State.

**Environmental Impact**

The adopted emergency rule shall have the positive environmental impact of reducing the consumption by humans of PCB contaminated fish. A serious environmental health problem shall be substantially reduced.

**EMERGENCY ADOPTIONS**

**Full text** of the emergency adoption and concurrent proposal follows:

SUBCHAPTER 18A

FISHERIES CLOSURES AND
ADVISORIES FOR STRIPED BASS.
AMERICAN EEL, BLUEFISH, WHITE PERCH AND WHITE CATFISH
TAKEN FORM THE NORTHEAST REGION OF THE STATE

7:25-18A.I  Authority

This subchapter has been promulgated pursuant to the Marine Fisheries Management and Commercial Fisheries Act, N.J S.A. 23:2B-I et seq.

7:25-18A.2 Scope and construction

(a) The following shall constitute the rules governing the issuance by the Department, of fisheries closures and advisories concerning PCB contaminated fish taken from the waters of the Northeast Region of the State.

(b) These rules shall be liberally construed to permit the Department to effectuate the purpose of these rules.

7:25-18A.3 Definitions

"Advisoty" means a Departmental warning to limit consumption of designated fish species taken from designated regions of the State's waters.

"Closure" or "closed" means prohibition of sales of designated fish species taken from designated regions of the State's waters.

"Commissioner" means the Commissioner of the Department of Environmental Protection.

"Department" means the Department of Environmental Protection.

"Limited consumption" or "limit consumption" means that in order to reduce exposure to and bioaccumulation of PCB’s persons of high risk, including but not limited to pregnant women, nursing mothers, women of child-bearing age, and young children, should not eat any designated fish species taken from designated regions of the State's waters and all other persons should not consume more than one meal per week of any designated fish taken from designated regions of the State's waters.

"Northeast Region" means the region encompassing the New Jersey portion of Sandy Hook and Raritan Bay; the tidal portions of the Raritan River upstream to the Route I Bridge in New Brunswick; the Arthur Kill and Newark Bay; the Passaic River upstream to the Dundee Dam; the Hackensack River up to Oradell Dam; the Kill Van Kull and Upper New York Bay; and the Hudson River upstream to the New Jersey-New York State border, approximately four miles above Alpine, New Jersey.

"PCB's" means polychlorinated biphenyls.

7:25-18A.4 Closure of fisheries

(a) The Commissioner finds, based upon scientific investigation, that to protect the public health of the citizens of the State the following designated regions of the State's waters shall be closed and the sale prohibited of the following designated fish species:

I . Prohibition of the sale of Striped Bass (Morone saxatilis) taken from the Hudson River, Upper New York Bay, Newark Bay, Lower Passaic River, Lower Hackensack River, Arthur Kill and Kill Van Kull; and

2. Prohibition of the sale of American Eels (Anguilla rostrata) taken from the Hudson River, Upper New York Bay, Newark Bay, Lower Passaic River, Lower Hackensack River, Arthur Kill and Kill Van Kull.

7:25-18A.5 Public advisories concerning fisheries

(a) The Commissioner finds, based upon scientific investigation, that to protect the citizens of the State, the following advisories concerning the taking of designated fish species from designated regions of the State's waters shall be set forth below:

## EMERGENCY ADOPTIONS

I . Advisory for the limited consumption of Striped Bass (Morone saxatilis) taken from the Northeast Region, including offshore State waters in the northern coastal area;

2. Advisory for the limited consumption of American Eel (Anguilla rostrata) taken from the entire State; especially the Northeast Region;

3. Advisory for the limited consumption of Bluefish (Pomatomus saltatrix) taken from the Northeast Region, including offshore State waters in the northern coastal area;

4. Advisory for the limited consumption of White Perch (Morone american) from the Northeast Region; and

5. Advisory for the limited consumption of White Catfish (Ictalurus catus) from the Northeast Region.

(b) The Department further advises that even said designated fish species to be consumed not more than one meal per week should be carefully prepared as set forth below;

1. Remove fat areas from designated fish species, for example, fish belly flaps or abdomens and dark meat portions; and

2. Bake or broil fish on an elevated rack, which allows PCB contaminated fat areas to drip free and away from the fish.

7:25-18A.6 Public notice of fisheries closures and advisories

(a) The Department shall utilize all reasonable and effective methods to publicize and educate the citizens of the State concerning all fishery closures and advisories pursuant to this subchapter, including but not limited to the following:

1 . Schedule appropriate press conference;
2. Prepare and distribute appropriate press releases;
3. Post informational notices and signs in appropriate locations;
4. Advertise public notices in State newspapers for a reasonable period of time;
5. Distribute public informational notices according to appropriate Departmental mailing lists; and
6. Compliance with notification requirements of the Administrative Procedures Act, N.J.S.A. 52:14B-I etseq., and the regulations promulgated thereto.

7:25-18A .7 Violations

Any person who violates any provision of this subchapter shall be liable to the full range of penalties set forth in Section 14 of the Marine Fisheries Management and Commercial Fisheries Act, N.J.S.A. 23:2B-14.

APPENDIX II

# RULE ADOPTIONS

## ENVIRONMENTAL PROTECTION

## (c)

### OFFICE OF CANCER AND TOXIC SUBSTANCES RESEARCH

**Fisheries Closures and Advisories for Striped Bass, American Eel, Bluefish, White Perch and White Catfish, Taken from the Northeast Region of the State**

**Readopted New Rule: N.J.A.C. 7:25-18A**

Proposed: January 3, 1983 at 15 N.J.R. 39(a).
Adopted: March 17, 1983 by Robert E. Hughey. Commissioner, Department of Environmental Protection.
Filed: March 17, 1983 as R.1983 d.l02, **with substantive changes** not requiring additional public notice and comment (see N.J.A.C. 1:30-3.5).

Authority: Marine Fisheries Management and Commercial Fisheries Act. N.J.S.A. 23:2B-I et seq.

Effective Date: March 17, 1983.
Expiration Date pursuant to Executive Order No. 66 (1978): March 16. 1988.
DEP Docket No. 060-82-12.

**Summary** of Public Comments and Agency Responses: **No comments received**.

**Full text** of the changes between proposal and adoption follows **(additions to proposal shown in boldface with asterisks *thus*; deletions from proposal shown in brackets with asterisks *[thus]*).**

7:25-18A.1-18A.5 (No change from proposal.)

7:25-18A.6 Public notice of fisheries closures and advisories

(a) The Department shall utilize all reasonable and effective methods
(b) to publicize and educate the citizens of the State concerning all fishery
(c) closures and advisories pursuant to this subchapter, including but not
(d) limited to the following:

1. Schedule appropriate press conference*s*;

2. Prepare and distribute appropriate press releases ***on May 15 and August 15 of each year, and as otherwise deemed necessary***;
3.(No change from proposal.)

4. Advertise public notices in State newspapers *[for a reasonable period of time]* *** on May 15 and August 15 of each year, and as otherwise deemed necessary***;

5.-6. (No change from proposal.)

APPENDIX II

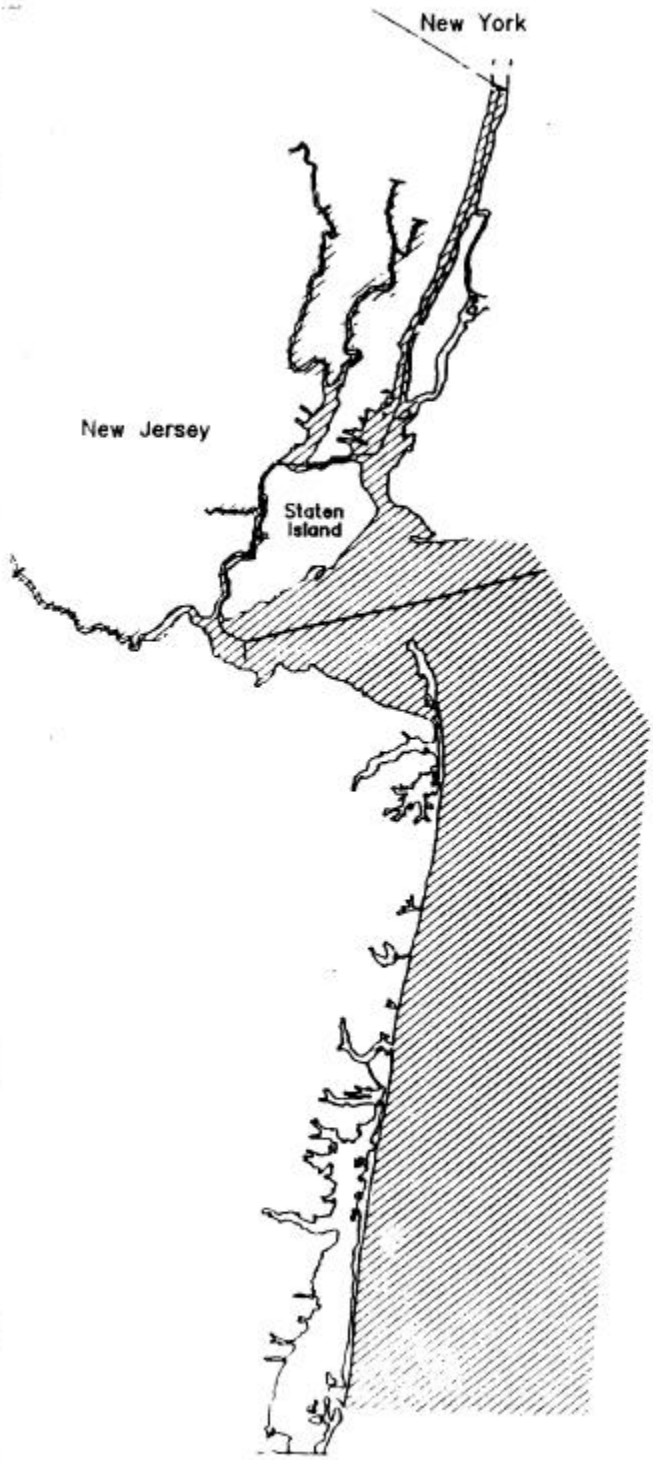
# CLOSED FISHING AREA DUE TO PCBs IN FISH TISSUE

## CLOSED AREA

Sale of STRIPED BASS AMERICAN EEL taken from these waterways is prohibited.

Closed area includes the following waterways and tributaries:

- Hudson River
- Upper New York Bay
- Newark Bay
- Tidal Passaic River
- Tidal Hackensack River
- Arthur Kill
- Kill Van Kull




# FISHING ADVISORY AREA DUE TO PCBs IN FISH TISSUE

## ADVISORY AREA

Advisory in effect to limit consumption of STRIPED BASS, BLUEFISH, WHITE PERCH, WHITE CATFISH, and AMERICAN EEL.

Advisory area includes the following waterways and tributaries:

- Hudson River
- Upper New York Bay
- Newark Bay
- Tidal Passaic River
- Tidal Hackensack River
- Arthur Kill
- Kill Van Kull
- Tidal Raritan River
- Raritan Bay
- Sandy Hook Bay
- Lower New York Bay

STRIPED BASS and BLUEFISH advisory includes Offshore Waters for Northern Coastal Area.

AMERICAN EEL advisory includes all waterways statewide.

TABLES

Table 1

Mean PCB* Results in ug/g(ppm) for Selected Finfish Caught within the Northeast Region+ of New Jersey

| | | 1975-1980 | | 1981 | | 1982 | | |
|---|---|---|---|---|---|---|---|---|
| ***Species*** | ***Size*** | ***Aroclor 1254 (pm)*** | ***Aroclor 1254*** | ***Aroclor 1248*** | ***Combined PCB*** | ***Aroclor 1254*** | ***Aroclor 1248*** | ***Combi PCI*** |
| ***Striped Bass*** | 45.72cm (18 in) | 3.58(17)** | 2.03(3) | 3.33(1) | 3.14(3) | 2.56(15) | 1.51(15) | 4.07( |
| | 45.72cm | 2.52(34) | 1.80(16) | 2.13(9) | 3.00(16) | 1.52(11) | 1.12(11) | 2.46( |
| | Comined Sizes | 2.87(51) | 1.84(19) | 2.26(10) | 3.02(19) | 2.21(26) | 1.35(26) | 3.47( |
| ***American Eel*** | | 2.29(14) | 2.28(13) | 1.18(1) | 2.32(13) | 2.06(7) | 2.80(7) | 4.86( |
| ***White Perch*** | | 2.10(23) | 1.39(12) | 1.23(4) | 1.79(12) | 3.81(3) | 2.00(3) | 6.80( |
| ***White Catfish*** | | 5.83(2) | 2.00(3) | 1.98(1) | 2.66(3) | 1.21(10) | 3.18(10) | |

*FDA Mean is Arithmetic Mean giving equal wight to both single and compsosite analyses
**Number of analyses
*As described by Belton et. Al. (4) and in this article

Table 2

PCB Results* in ug/g (ppm) for Selected Finfish Caught within the Hudson-Raritan Estuary Sampling Locations

| Species | Sample Year | Hudson River | | | Passaic River | | | Raritan Bay | | | Raritan Bay | | | Arthur Kil | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | X** | Range | N | X | Range | N | X | Range | N | X | Range | N | X | Range |
| Striped Bass | 1981 | 1.56 | (0.16-5.03) | 40 | 6.04 | (1.24-14.85) | 5 | 3.93 | (0.63-7.23) | 2 | | | | | |
| | 1982 | 3.18 | (0.76-11.5) | 90 | | | | | | | | | | | |
| American Eel | 1981 | 3.50 | (0.9-7.86) | 20 | | | | 1.06 | (0.9-1.21) | 6 | 0.92 | (0.72-1.04) | 12 | | |
| | 1982 | 4.80 | (2.68-7.58) | 11 | 7.18 | (7.18) | 5 | | | | | | | 4.09 | (4.09) |
| White Perch | 1981 | 1.31 | (0.9-1.58) | 10 | 3.72 | (0.51-10.03) | 15 | | | | 0.62 | (0.25-1.29) | 17 | | |
| | 1982 | 6.34 | (4.97-8.07) | 7 | | | | | | | | | | | |
| White Catfish | 1981 | 1.89 | (1.25-2.52) | 6 | 4.21 | (4.21) | 6 | | | | | | | | |
| | 1982 | 3.12 | (1.86-5.69) | 38 | | | | | | | | | | | |

*1981 results are for Aroclor 1254 with some limited Aroclor 1248 analyses included, mostly for the Passaic River fish.

All 1982 fish were analyzed for both Aroclors and are reported as totaled PCBs.

**FDA Mean is the Arithmetic Mean giving equal weight to both single and composite samples, N is the number of organisms caught and analyzed.

Table 3

PCB and Pesticide Levels* for Bluefish Caught within the Northeast Region and Control Waters of N.J.*

| | PCB Results | | | | Pesticide Results |
|---|---|---|---|---|---|
| | 1975-1981*** | 1982 | | | 1982 |
| Size | Aroclor 1254(ppm) | Aroclor 1254 | Aroclor 1248 | Combined PCBs | Total Chlordane(ppb) |
| 60cm | 1.59(44)** | 0.71(14) | 2.33(14) | 3.03(14) | 207.93(14) |
| 40-60 cm | 1.20(21) | 0.34(13) | 0.20(13) | 0.54(13) | 47.95(13) |
| 40cm | 1.04(62) | 0.45(8) | 0.25(8) | 0.70(8) | 25.88(8) |
| Combined | 1.25(127) | 0.50(35) | 0.93(35) | 1.42(35) | 93.92(35) |

* Results are expressed as the FDA mean or Arithmetic mean given equal weight to both single and composite analyses.

PCB results are in ug/g (ppm) while pesticide levels are in ug/kg (ppb).

**Number of analyses.

***Only a small number of Bluefish samples were caught in 1981 so they were pooled with the 1975-1980 data set.

*The Northeast Region is that as defined by Belton et. Al. (82). Coastal waters include sites from Sandy Hook south to Barnegat inlet, from the surf line to thirty miles offshore.

Table 4

PCB and Chlordane Levels for Bluefish by Location

Sampling Location's

| **Chemical** | Sample Year | Hudson River | | | | Raritan/Sandy Hook Bays | | | | Coastal+ | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A* | X | Range | N | A | X | Range | N | A | X | Range | N |
| PCB** | 1981 | 2 | 1.78 | (1.57-1.99) | 3 | 4 | 1.29 | (0.49-2.31) | 12 | - | - | - | - |
| Ug/g (ppm) | 1982 | 3 | 1.55 | (1.38-1.70) | 11 | 4 | 0.46 | (0.32-0.69) | 20 | 28 | 1.73 | (0.1-8.28) | 123 |
| Chlordane*** | 1981 | 2 | 205.9 | (127.4-284.5) | 3 | 4 | 110.1 | (2.5-232.1) | 12 | - | - | - | - |
| Ug/kg(ppb) | 1982 | 3 | 36.93 | (30.4-50.0) | 11 | 4 | 27.75 | (18.21-39.03) | 20 | 28 | 125.7 | (11.21-357.6) | 123 |

* A=Number of analyses performed
X=FDA Mean is the Arithmetic Mean giving equal wight to both single and composite samples.
N=Number of organisms analyzed.
**1981 Results are for Aroclor 1254 with some limited Aroclor 1248 analyses included. All 1982 fish were analyzed for both Aroclors and are reported as total BCBs.
***Chlordane is reported as the same of the alpha and gama chlordane isomera.
+Coastal waters include sites from Sandy Hook south to Barnegat Inlet, from the surf line to thirty miles offshore.

Table 5

Percentage of Fish Caught within the Northeast Region
Of New Jersey During the 1982 Sampling Season as Specified
By Certain Regulatory Ranges + for PCBs*

Percentages

| Species (N)** | Minimal Levels (0.1-2.0 ppm)PCBs | Advisory Range (2.0-5.0 ppm)PCBs | Closure Range (5.0 ppm) PCBs |
|---|---|---|---|
| Bluefish (154) | 68% (24) *** | 26% (9) | 6% (2) |
| Striped Bass(90) | 35% (9) | 45% (12) | 19%(5) |
| American Eel 21) | 0% | 71% (5) | 29% (2) |
| White Catfish (38) | 10% (1) | 80% (8) | 10% (1) |
| White Perch (7) | 0% | 33% (1) | 67% (3) |

*PCBs results are for Aroclor 1254 and 1248 summed (ug/g or ppm)
**Number of organisms caught
***Number of analyses formed
+Existing FDA Tolerence is 5.0 ug/g
Proposed FDA Tolerence is 2.0 ug/g

Table 6

COMMERCIAL FISHERY STATISTIC FOR NEW JERSEY (1976)

| Species | Recreational Total No.Caught 1979* | Commercial Landing(lbs.) 1976 | Commercial Dollar Value($) 1976 |
|---|---|---|---|
| 1.Summer Flounder | 5,142,000 | 5,647,000 | $2,341,000 |
| 2.Bluefish | 4,948,000 | 1,280,000 | 145,000 |
| 3.Winter Flounder | 1,434,000 | 147,000 | 26,000 |
| 4.Weakfish | 1,372,000 | 5,709,000 | 555,000 |
| 5.Atlantic Mackerel | 969,000 | 1,852,000 | 151,000 |
| 6.Striped Bass | 30,000 | 137,000 | 102,000 |

*Statistics Compiled by U.S. Department of Commerce
Current Fisheries Statistics

Table 7

A.MARINE RECREATIONAL FISHERIES IN N.J. * (1979)

| | Total Fish Caught |
|---|---|
| 1. Summer Flounder | 5,142,000 |
| 2. Bluefish | 4,948,000 |
| 3. Winter Flounder | 1,434,000 |
| 4. Weakfish | 1,372,000 |
| 5. Altantic Mackerel | 969,000 |
| 6. Striped Bass | 30,000 |

B.Percentage of Fishermen Affirming Species Groups Sought in Mid-Atlantic Region+

| | Percentage |
|---|---|
| 1.Bluefish | 25.59 |
| 2.Summer Flounder | 15.61 |
| 3.Weakfish | 10.50 |
| 4.Striped Bass | 10.49 |
| 5.Winter Flounder | 7.85 |
| 6.White Perch | 3.39 |
| 7.None | 32.62 |

*Marine Recreational Fishery Statistics Survey, Atlantic and Gulf Coast, 1979. U.S. Dept. of Commerce, Current Fishery Statistics Number 8063. December, 1980.

+=972,000 Participants in the Marine Recreational Fishery in N.J. for 1979.